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THE JOURNAL OF PHILOSOPHY

DIALECTICAL ARGUMENTS AGAINST RELATIVE SIMULTANEITY

TIME as it is experienced is, by tautology and therefore without doubt, what it is "experienced as." Unless we experienced it with its simultaneities and its successions, we might talk about "time," but if we did we should not mean by that word what we now actually mean by it. So long as it was not known that light was propagated with finite velocity, there was no reason for distinguishing physical simultaneity from seen simultaneity. Since seen simultaneity was just what it was immediately experienced as, so physical simultaneity was just what seen simultaneity was immediately experienced as; and unseen physical simultaneity was simply seen simultaneity extrapolated. But because what was seen as simultaneous was not necessarily heard as simultaneous, a distinction had to be made between physical simultaneity and immediately experienced simultaneity; the distinction, however, was a distinction between a species and its genus.

This happy state of affairs came to an end when Roemer, discovering that the eclipses of Jupiter's moons did not always occur at the predicted times, accounted for this discrepancy to the satisfaction of astronomers and other physicists as due to the finite velocity of light. From that time on, not all seen simultaneity could be treated as identical with physical simultaneity; only *some* seen simultaneity could be so treated. *Physical simultaneity was seen simultaneity of events at equal distances from the observer.* Let us call this "Definition 1." According to this definition physical simultaneity is not "a logical primitive."[1] We may admit, if only for the sake of argument, that the genus, "seen simultaneity," is logically primitive; but the combination of genus and specific difference is not so, unless we maintain that a concept which is capable of analysis is still logically primitive.

At any rate, it is significant that the definition italicized above defines physical simultaneity by the introduction of a *spatial* factor.

[1] "The Dialectical Argument against Absolute Simultaneity," by Arthur O. Lovejoy, this JOURNAL, Vol. XXVII., p. 626. Hereafter in this paper all page references, not otherwise assigned, are to this article, which appeared in two instalments, pp. 617–632, 645–654, November 6 and 20, 1930.

What we are trying to define is a time-concept; but somehow, in the process of definition, it reveals itself as a space-time concept. We should not therefore be surprised if in the further consideration of physical simultaneity its inextricableness from space should remain to puzzle us with our naïve notion that time is time and space is space, and that logically never the twain shall meet. Nor should we stand aghast when we hear Minkowski, as mathematical *physicist*, say: "Henceforth space *by itself*, and time *by itself*, are doomed to fade away into mere shadows, and only a kind of *union of the two* will preserve an independent reality."[2]

Now the observer who *sees* physically simultaneous events as simultaneous does so because light from such events arrives simultaneously at his physical eyes; and since "most physicists," as Lovejoy says (p. 621), are too realistic "to be content with so subjectivistic a definition" of simultaneity as one that includes any psychological factor like seeing, it is not strange that they should, in their definition of physical simultaneity, replace the observer by *any physical object* at which light arrives. Just when "seeing" occurs in the course of natural events is not the immediate concern of the physicist as physicist; it may occur immediately upon the arrival[3] of light at the eyes of the observer, or it may lag behind the time of this arrival by some as yet unmeasured interval. It is not the arrival of light at the "seeing" (whatever that may mean) or at the "mind" that sees, that interests the physicist, but the arrival of the light at some *physical object*, e.g., his eye. We can then revise our Definition 1 thus: Physical simultaneity is the time-relation between two physical events, light from which arrives

[2] I quote from the translation of Minkowski's "Space and Time" by Perrett and Jeffery, in the collection of memoirs by Lorentz, Einstein, Minkowski, and Weyl, entitled *The Principle of Relativity*, Methuen & Company, Ltd., London, 1923, p. 75. The German volume is entitled *Das Relativitätsprinzip*, Teubner, Leipzig and Berlin. I shall refer to the 5th edition of the work, 1923. The present reference is to p. 54. The italics in the quotation just made are mine.

[3] When I speak of the "arrival" of light at any place, I do not wish to be considered as taking sides in the dispute as to whether light is "a thing that travels." The "arrival of light at a place" is, in this paper, to mean no more than the occurrence at that place of an electro-magnetic process because some electro-magnetic process has occurred elsewhere. Whether, in the time-interval between the two occurrences, continuous processes occur between the two places involved, makes no difference in my present discussion. I wish to file a similar *caveat* with reference to the use of the expression "the propagation of light." Just as a man may speak of the "rising" of the sun whether he believes that "the sun do move," or whether he believes that it is the rotation of the earth that gives rise to the appearance of the "rising" of the sun, so one may speak of the "departure," or of the "propagation," or of the "arrival," of light, without necessarily committing oneself on the question whether light actually *travels*.

simultaneously at a physical object equally distant from the places of the two events. This definition keeps in touch with what simultaneity is "experienced as," inasmuch as the two events *would be* immediately "experienced as simultaneous" *if* there were any observer at the place of the arrival of the light. Here as elsewhere through our discussion we assume the constancy of the velocity of light.

But suppose that the object that receives the light is moving toward one of the sources of light, and away from the other. Well, let us then exclude such a case from our definition. We now revise our previous revision and give "Definition 2": Let *A*, *B*, and *O* be any three places at fixed distances from each other, the distance *A-O* being equal to the distance *B-O*. *Physical simultaneity is the time-relation between any event at A and any event at B, light from which two events arrives simultaneously at O.* If *A* and *B* should be the same place, the above definition holds, *because then O is equally distant from the two events.* In other words, Definition 2 covers cases in which two events occur at the same place and also cases in which two events occur at a fixed distance from each other. But cases of the former class have the distinguishing characteristic that *any point O chosen at random* is equally distant from the two events, whereas, if *A* and *B* are at a distance from each other, only those points that lie on a line perpendicular to the line *AB* and passing through the point *M* midway between *A* and *B* will satisfy the condition laid down for *O*. Thus we see that physical simultaneity defined as in Definition 2 has *the same connotation* for events at the same place and for events at different places.

But we may revise our definition still further. Let *A*, *B*, and *P* be any three points at fixed distances from each other, and let *m* be the distance *A-P*, and *n* be the distance *B-P*. Let t_1 be the time of arrival at *P* of light from an event at *A*, and t_2 be the time of arrival at *P* of light from an event at *B*. Then the time at which the light started from *A* is $t_3 = t_1 - m/c$, where *c* is the velocity of light; and the time at which light started from *B* is $t_4 = t_2 - n/c$. Now, if $t_1 - t_2 = m/c - n/c$, then $(t_1 - m/c) - (t_2 - n/c) = 0$. Translated into the vernacular, this means: *If the time-interval between* (a) *the arrival at P of the light from A and* (b) *the arrival at P of the light from B is equal to the difference between* (c) *the interval between the departure of the light from A and its arrival at P, and* (d) *the interval between the departure of the light from B and its arrival at P, then physical simultaneity is the time-relation between* (e) *the departure of the light from A and* (f) *the departure of the light from B.* This is our "Definition 3." It includes Definition 2 as a special case in which $m = n$. It also includes the case in which

P is identical either with A or with B since in this case the time-interval between the departure of the light from A (or from B) and its arrival at P is zero. Thus Definition 3 meets the demand made by Lovejoy: "The 'what' of 'simultaneity,' in short, may be—and, if the word is to be used in the sense familiar to all mankind, must be—the same wherever the events of which it is predicated" (p. 629); and we have also a definition that indicates the procedure for determining the "that" of physical simultaneity.

If it be objected that our Definition 3 is not a definition but a test of simultaneity, I can only quote Lovejoy: "A proposition asserting the simultaneity of two events is, obviously, an assertion concerning the magnitude of the time-interval between them—namely, that the interval is equal to zero" (p. 624). I do not know whether this means that for Lovejoy the simultaneity of two events "means" that the interval between them is equal to zero, or whether for him it means that a zero-interval is a "test" of simultaneity. At any rate it is an *adequate* test. Now Lovejoy has himself often urged, in argument against the epistemological monist, that immediately experienced simultaneity is *not* an adequate test of physical simultaneity. But if physical simultaneity is to be distinguished from immediately experienced simultaneity, and if the function of a definition is adequately to distinguish the definiendum for purposes of identification, I know of no way to define physical simultaneity as differentiated from immediately experienced simultaneity except in terms of an assumed uniform velocity of some kind of signal over measured distances. Can Lovejoy suggest a better way?

But there is still another characteristic of experienced simultaneity that we should carry over with us when we extrapolate simultaneity, namely, its transitivity. If, of three events, the first and second are simultaneous, and the second and third are simultaneous, the first and third are also simultaneous.[4]

The definitions above given of physical simultaneity are, of course, not original. They have been implied in the use of the concept of physical simultaneity for some two centuries and a half.

[4] I am not at all sure that in immediate experience this is always the case. We are all familiar with the fact that such transitivity of equality is not realized in immediate experience in the case of weights. In the same way, do we always experience a first and third event as simultaneous, when we experience the first as simultaneous with the second, and the second as simultaneous with the third? Perhaps this question is put in too simplified form; it may be that more than three events are necessary to exemplify what is a lack of precise discrimination in our immediate experience of simultaneity. But this whole question (which can not be adequately discussed without raising the whole question of "epistemological dualism") is irrelevant to our present interest, which is concerned with the fact that we do insist that physical simultaneity shall be transitive.

It was the merit of Einstein that he expressly formulated them. Definition 3 is in substance the one given in his first paper, "On the Electrodynamics of Moving Bodies."[5] Definition 1 is that given in his popular book,[6] from which Lovejoy quotes under the abbreviated title, "Relativity." But Lovejoy finds *three* different definitions of simultaneity in Einstein, and he finds an arbitrariness in one of them, whereas the reader will admit, I trust, that the definitions that I have given, following Einstein, are not arbitrary. At least he will perhaps admit that, if they are arbitrary, the arbitrariness runs back to Roemer and has since become habitual in science and in common sense. Let us quote Lovejoy:

> in fact he [Einstein] recognizes three different possible definitions corresponding to three classes of pairs of events about the simultaneity of which question may be raised—though only the third is important for his main argument. (i) There is, first, psychological or subjective simultaneity, the conjunction in a single specious present, in the experience of one individual, of two or more sense-data or other items of content. . . .(ii) There is, however, one class of physical events in which psychological simultaneity may be regarded as the virtual equivalent of physical simultaneity—viz., those events which occur in the immediate vicinity of one another and of the body of the observer. Where there is very close proximity in space, the observer may treat the time at which an event is perceived as approximately the same as *its* time; and if he has set up clocks the readings of which are determined by some convention, he may "understand by the 'time' of the event the reading (position of the hands) of that one of the clocks which is in the immediate vicinity (in space) of the event." (iii) This, however, aside from being only a definition of approximate or virtual physical simultaneity, does not apply to events which are distant in space from one another, and at least one of which, therefore, must be distant from the place occupied by the observer—since he can not be in two places at once. . . . The required definition, then, must be in terms of the following operation: Let the distance *A-B* on the line joining the loci of the two events be actually measured off on some rigid reference body by laying down a measuring rod in the usual manner; [This is vague: the reference body should be at rest with respect to "the loci of the two events." But let this

[5] See pp. 39–40 of the translation in *The Principle of Relativity*, mentioned in footnote 2, and see also p. 28 of the German *Das Relativitätsprinzip*. Einstein's paper of 1905 I shall hereafter for brevity refer to as "*Electrodynamics.*" I have said above that the definition given by Einstein in this passage is substantially the same as our Definition 3. Einstein first gets clocks at *A* and at *B* (these points being at a fixed distance from each other), whose equal readings are simultaneous by our Definition 3, applied to the case where *P* is identical either with *A* or with *B*. Then events at *A* and at *B*, which are respectively simultaneous (by our Definition 3, applied to the case where *P* is first identical with *A* and then with *B*) with the simultaneous clock-readings at *A* and at *B*, are simultaneous with each other, by the postulate that simultaneity is transitive.

[6] *Über die spezielle und die allgemeine Relativitätstheorie* (*Gemeinverständlich*), VieWeg & Sohn, Braunschweig, 5te Aufl., 1920. Hereafter I shall refer to this book as "*Relativitätstheorie.*" I regret that I have not at hand the English translation to refer to.

pass.] let an observer be placed at a point between *A* and *B*, and equidistant from them, and let him be provided with instruments (e.g., mirrors) "which allow him visually to observe both places *A* and *B* at the same time" —or more precisely, which allow him to observe the arrival of light-signals from those places at the same time. If he then in fact perceives at one and the same instant the arrival of two light-rays known to have been projected or reflected from *A* and *B*, the events indicated by the two signals . . . may be said to be simultaneous. Such, then, is the new experimental and physical definition of simultaneity from which revolutionary consequences are shortly to follow. It is to be borne in mind that, according to Einstein, this is the only definition of the term, applicable to physical and distant events, which has any meaning whatever (pp. 621–623).

As to definition (i), which is not for Lovejoy at issue, I can only say that I *presume* that Einstein recognizes "psychological or subjective simultaneity," although I doubt whether he would subscribe to the looseness of Lovejoy's identification of what "is manifestly a logical primitive" (p. 626). Events may be conjoined *successively* in the specious present as well as simultaneously. But I don't happen to remember any discussion by Einstein of such "psychological simultaneity."

When we come to definition (ii), a protest is in order. I can find nowhere, in either of the two Einsteinian documents I have referred to, any indication that Einstein regards psychological simultaneity "as the virtual equivalent of physical simultaneity"; Lovejoy supposes him to do so because when events occur "in the immediate vicinity . . . of the body of the observer" he "may treat the time at which an event is perceived as approximately the same as *its* time." As a physicist Einstein has shown no interest in the question of the time of the perceiving. It is not the time of the *seeing* that Einstein wishes to determine, but the time of what is seen; and this, not in relation to the time of seeing, but in relation to the time of something else seen. Lovejoy thus introduces a factor into Einstein's definition of physical simultaneity that may be of great interest to the philosopher or to the physiological psychologist, but a factor in regard to which Einstein as physicist has taken no position, so far as I remember, in his physical memoirs. Let us keep extraneous matters out of our discussion. Definition (ii) of Lovejoy's list is nowhere recognized by Einstein as a definition of physical simultaneity, whether "virtual" or not. It is *Lovejoy's* definition foisted on Einstein, with the result that he can count "three."

But this is an infinitesimal peccadillo compared with what follows. With regard to definition (iii) Lovejoy says: "Einstein himself (*Relativity*, pp. 27–28), it should be noted, insists that he is not here making either 'a supposition or a hypothesis about the physical nature of light,' but merely a 'stipulation in order to arrive at a

definition of simultaneity'" (p. 622). This "insistence" is taken as proving that Einstein's definition is "mainly a free or arbitrary definition—a verbal and not (as some of his interpreters suppose) a 'real' proposition. In three points, two implied, one explicit, it is not arbitrary. It is assumed that the term to be defined must designate a *relation between events;* . . . and that this is something distinguishable from the purely spatial relations of distance and direction between the events in question." Besides these tacit restrictions, "he expressly accepts the restrictions of the general experimental theory of meaning" (pp. 645).

As to "the experimental theory of meaning," Einstein does not say that a physical definition is a statement of an operation to be performed. He says: "Es bedarf also einer solchen Definition der Gleichzeitigkeit, dass diese Definition die Methode *an die Hand gibt,* nach welcher im vorliegenden Falle aus Experimenten entschieden werden kann, ob beide Blitzschläge gleichzeitig erfolgt sind oder nicht."[7] The definition must *furnish* a method. The definition of a circle is not a definition of the method of ascertaining whether a figure is a circle, but from the definition one can know how to go about finding out whether a figure is a circle. The circularity of a circle is not the method employed in discovering whether it is a circle, but a character discovered by the use of the method *suggested* by the definition. Professor Bridgman (if Professor Dewey in *The Quest for Certainty* is correct in interpreting him) has given only one of at least two possible definitions of an "experimental definition," or of an "experimental concept"; and that definition is not the one that Einstein gives here.

Let this pass, and let us quote further:

> But if these are the only antecedent limitations to one's freedom of definition . . . why should Einstein's be regarded as *the* definition of distant-simultaneity, all others being spurious? . . . Einstein offers no reason whatever for supposing that no "empirical definition" except his own is possible; and in fact many others are manifestly conceivable. One such . . . has been pointed out by M. André Metz. . . . It would, suggests M. Metz, be an equally "empirical" definition "if one substituted the term 'sound' for 'light' in the formula." . . . This would assuredly seem to common sense, as it does to M. Metz, a wrong definition, because the propagation of sound is by them supposed to be already known, in advance of the definition, to be not isotropic; but this objection arises only because both M. Metz and common sense assume an already given "natural concept of simultaneity," the fulfilment of which would not be shown by the joint-arrival of the signals at the mid-point *M* unless their velocities over the distances *A-M* and *B-M* were known to be uniform and their times of transit over these distances therefore equal. . . . But Einstein accepts no such ready-made *a priori* conception . . . and it is not because he already *knows,* or can even meaningfully assume, that light is isotropic and sound is not that he defines simultaneity in terms of the joint-arrival of light rather than of

[7] *Relativitätstheorie,* § 8, p. 14. The italics are mine.

sound-signals at the point *M*. This he is himself careful to point out. He imagines a critic who raises the objection that his definition presupposes a previous knowledge of the fact that light always traverses equal distances in equal times . . . and that it would therefore "appear as though we were moving here in a logical circle." But Einstein replies that his "definition assumes absolutely nothing about light. . . . That light requires the same time to traverse" the two paths "is in reality neither a *supposition* nor a *hypothesis* about the physical nature of light, but a *stipulation* which I can make of my own free will in order to arrive at a definition of simultaneity." . . . In short, in order to avoid circularity in his definition, Einstein finds it necessary, not merely to define "simultaneity" itself arbitrarily, but also to define arbitrarily one of the terms entering into the former definition. . . . We are to understand, then, that Einstein's definition of simultaneity-at-a-distance is, and is by its author intended to be, one adopted "of his own free will"—subject only to "the one demand," or at most the three demands, already mentioned [pp. 646-647].

With apologies for a blunt outright contradiction let me say: We are to understand no such thing, and the reason we are not is that *Lovejoy has attributed to Einstein* words that *Einstein expressly attributes to the "reader"* with whom he represents himself as discussing the question; and Lovejoy has attributed to an imaginary *"critic" of Einstein's definition* the criticism that *Einstein himself* makes against the *reader's suggested definition.* Any one who reads even cursorily the passage from which Lovejoy quotes should see that in it Einstein is attempting to lead the popular reader—the book is *gemeinverständlich*—to the adoption of Einstein's own definition and, if he is a careful reader, to a recognition of the assumptions underlying the definition. In the course of this guidance the reader is induced to propose a definition, against which Einstein urges an objection; the reader revises his definition, and Einstein urges another objection, and so on. (It is impossible here to quote the passage in full.)[8] Why should the positions taken by the persons in the dialogue be reversed when passages from the dialogue are quoted?

But this is not all. Lovejoy does not wait till Einstein has finished his say. He should have quoted more. Immediately following the sentences he quotes without the quotation marks that Einstein uses, the latter proceeds: "It is clear that this definition can be used in order to give an exact meaning to the assertion of the simultaneity, not only of *two* events, but of any number of events whatever, however the places of the events may be spread out (*gelagert sein mögen*) relatively to the reference body." Then he adds a footnote: "We assume further" the transitivity of simultaneity. "This assumption (*Annahme*) is *a physical hypothesis concerning the law of the propagation of light; it must be unconditionally fulfilled* (*sie muss unbedingt erfüllt sein*) *if it is to be pos-*

[8] *Relativitätstheorie*, § 8, pp. 14–16.

sible to maintain the law of the constancy of the velocity of light in vacuo" (my italics). Thus Einstein accepts the reader's definition and his discretionary stipulation, but only after revision of the latter. It is too free. To be consistently applicable it must carry with it the physical assumption of the constancy of the velocity of light.[9] (That Einstein has put this in a footnote should not mislead any one who knows that in a popular work written by an expert, footnotes are likely to be quite important.) It is a pretty generally recognized principle among logicians that a definition is to be understood in terms of the postulates under which it is framed. In the case before us, Einstein inserts the footnote, just quoted, and thus corrects the "reader," *before* he proceeds to remark: "Herewith we arrive also at a definition of 'time' in physics." Note that he does not say "the only possible definition." As we shall see, he had given another definition in another work. But the two definitions agree in using the principle of the constancy of the velocity of light, and in recognizing that "simultaneity" is the time-relation between events the time-interval between whose occurrences is equal to zero. The two definitions differ as to the *method* of determining when events are thus simultaneous.

But it was not only in a footnote that Einstein stated his acceptance of the law of the constancy of the velocity of light *in vacuo* as presupposed by his definition. In § 7, immediately preceding the section from which Lovejoy quotes, Einstein gives several experi-

[9] Lovejoy is apparently not responsible for the translation he gives, since Professor C. I. Lewis gives the same translation, although the latter preserves Einstein's quotation marks (*Mind and the World Order*, pp. 254–256). Lewis, however, gives the reader the impression that Einstein leaves the "stipulation" *without physical presupposition* as the last word in his discussion.

The German for "of my own free will" is *nach freiem Ermessen*. There is a world of difference between acting "arbitrarily" and acting "at one's free discretion." An ambassador who is given free discretionary powers is not thereby authorized to act arbitrarily. College authorities who expel a student "at their free discretion" would find themselves in trouble with the courts if this discretion were arbitrarily exercised, as for instance in expelling a student because his father had died.

The "reader" in the case before us, who is using his free discretion in establishing a fixed basis (*Festsetzung*) on which to build his definition of simultaneity, seems in fact to be taking the position of common sense, which, as Lovejoy himself says, "supposing itself to be already well acquainted with what is meant and implied by 'simultaneity-at-a-distance,' finds therein reasons for holding that light-signals are at least *more* serviceable than sound-signals [or anything else available] as means to inferring, from a given point, whether two events remote from that point did or did not occur simultaneously" (p. 646). The "reader" would probably say "for determining" rather than "for inferring," since he has been called upon to give a definition available to a physicist (or to a layman) *for the purpose of determining whether the concept to be defined is applicable in a controverted case.* Using his judgment (*Ermessen*) he chooses light as affording the best basis for such a definition.

mental reasons for accepting this law, and then calls upon the reader to assume (*annehmen*) that "the school child is correct in believing in the simple law of the constant velocity of light *in vacuo.*" When, in view of the principles of classical dynamics, it appears inevitable "to surrender either the Principle of Relativity or the simple law of the propagation of light *in vacuo,*" he represents the "*reader*" as certainly expecting to hold fast to the Principle of Relativity and to surrender the law. But *he himself* says that "the development of physics showed that this way is not open." The researches of Lorentz showed that experiments in the fields of electrodynamics and optics "lead with compelling necessity (*mit zwingender Notwendigkeit*) to a theory of electromagnetic processes, which has as its inevitable consequence (*zur unabweisbaren Konsequenz*) the law of the constancy of the velocity of light *in vacuo.*" Hence the leading theorists were disposed to hold to that law and let the Principle of Relativity go. "It was here that the Theory of Relativity came in. By an analysis of the physical concepts of time and space it was shown that as a matter of fact there is no irreconcilability between the Principle of Relativity and the law of the propagation of light." Immediately after the paragraph in which this statement is made, the dialogue begins between Einstein and the reader. Has Einstein given up the law of the constancy of the velocity of light while turning over a page of his manuscript?

There are two words of Einstein in this dialogue that might be cited against the interpretation I have given. He introduces the reader's disavowal of any presupposition as to the physical nature of light, with a remark quite in the spirit of Plato. He says: "After some further reflection, however, you [reader] justifiably (*mit Recht*) give me a somewhat scornful look and explain to me. . . ." Why the words "*mit Recht*" if Einstein does not accept the reader's views? I venture the suggestion that these words express a recognition by Einstein that the reader is on the right track; that he has the right to use his discretion in selecting a basis for an experimental definition. But to be on the right track is not equivalent to seeing to the very end of it. Einstein later points out that the reader is wrong in not seeing the physical implications of his selection. Be this as it may, the words "*mit Recht*" are the only show of support for Lovejoy's interpretation; and it surely is doing violence to Einstein's language to attribute to him a meaning which he expressly attributes to the "reader" and which he expressly repudiates in the footnote to the first sentence immediately following. This violence becomes more apparent when we remember what Einstein had said just before this dialogue began.

But this is not all. The book from which all this is taken is a

popular book, and in a footnote to the first sentence of the *Preface* the author refers the reader to some of his previous publications collected in the volume entitled *Das Relativitätsprinzip*. This volume contains the famous "*Electrodynamics,*" in the first section of which Einstein says of the description of "the *motion* of a material point" in terms of "the values of its coordinates as functions of the time," that "a mathematical description of this kind has no physical meaning unless we are quite clear as to what we understand by 'time.' We have to take into account that all our judgments in which time plays a part are always judgments of *simultaneous events.*" The question then arises as to how to define simultaneity. After rejecting some possible suggestions, he proceeds: "We arrive at a much more practical determination (*zu einer weit praktischeren Festsetzung*) along the following line of thought."[10]

He then proceeds to give what is substantially our Definition 3. Immediately thereafter he says: "We assume that this definition of synchronism is consistently possible, and that too for any number of points, *therefore* that (*dass also*) the following relations are universally valid:—

"1. If the clock at B runs synchronously with the clock at A, the clock at A runs synchronously with the clock at B.

"2. If the clock at A runs synchronously with the clock at B as well as with the clock at C, the clocks at B and C also run synchronously with each other."

Then on the next page, at the beginning of the next section, he says: "The following reflexions are based on the principle of relativity and on the principle of the constancy of the velocity of light." *After* thus stating clearly his postulates and his definition of simultaneity made under the control of these postulates, he proceeds to deduce the Special Theory. Thus there is no shadow of a doubt that in 1905 Einstein wished it to be understood that his *Festsetzung* was not arbitrary; it assumed the reflexiveness and the transitivity of simultaneity; and also the constancy of the velocity of light. Still another assumption as to physical simultaneity is made by Einstein in the course of the development of the Special Theory: he assumed that any events occurring at *any* two points in a plane perpendicular to the relative motion of any two systems, if simultaneous in either system, are also simultaneous in the other. In spite of all these assumptions that restricted the "arbitrariness" of Einstein's definition of simultaneity, Lovejoy now asks us to be-

[10] *The Principle of Relativity*, pp. 38–39; *Das Relativitätsprinzip*, pp. 27–28. Note here the same word *Festsetzung*. The sequel will show that *this Festsetzung* also is made under the assumption of the transitivity of simultaneity. In what follows I have made some changes in the translation, especially to bring out the force of "*also.*"

lieve that "so careful a writer," as he himself has characterized Einstein (p. 627), gave his definitive view of simultaneity in a passage put into the mouth of a "reader," in which the latter spoke of exercising his free discretion, without assuming anything as to the physical nature of light.

Is it not evident that Lovejoy's main contention in his attack upon the relativistic conception of physical simultaneity, namely, the contention that this conception is arbitrarily chosen in order to "permit the [relativistic] conclusion desired to be drawn" (p. 649), is based (1) on an amazing mishandling of quotations and an ignoring of quotation marks and of context, with the result that the positions taken by the interlocutors in Einstein's brief dialogue are completely interchanged; (2) on Lovejoy's failure to note the footnotes in a popular book written by the author he is criticizing; and (3) on his failure to compare the popular version with the technical presentation in the *"Electrodynamics,"* to which the popular work refers at the very outset? Lovejoy has unquestionably read quite widely about relativity; why did he not read Einstein's first paper, which laid the foundations of the theory he is criticizing? If he did read it, why does he ignore what that paper clearly laid down as its initial postulates, and then proceed to criticize the author of that theory for doing exactly the opposite of what the author actually did in that paper? One would think that Lovejoy's knowledge that "other expositors of the theory explicitly recognize that an already experimentally-established factual proposition about the behavior of light-rays must here be introduced into the argument in order to justify the definition" (p. 622), would have served as a warning against the kind of misinterpretation he himself dares to give.

If space permitted, I should like to examine the other contentions of Lovejoy's article. *Nach meinem freien Ermessen,* they are all as unsound as the main contention I have discussed. But I must pass to the last point he makes, and discuss it, since, if he is correct on this point, the theory of relativity is of course impossible. Let me quote him quite at length. He says that

> Einstein himself does not adhere to the relativistic conclusion [as to the relativity of simultaneity] . . . and that he can not do so without vitiating his argument. For, after he has ascribed to each moving system a "time" of its own, in which events simultaneous on any other such systems are of differing date, he continues to speak of periods of time during which the two systems are in motion with respect to each other, and during which, also, some determinable number of events is occurring on each. *While* such and such things are happening on *S*, . . . such and such other things are happening on *S'*. Now this sort of proposition can have no meaning if there is no *common* duration with a common measure, to which the motion of both systems with respect to one another, and the two series of events, are referred. You can not say that while *S* moves to the right *S'* moves to the left, if there are in

reality simply two distinct "whiles," one definable solely with reference to S and the other solely with reference to S'; for in that case, you will have isolated the two systems so completely from one another that the relation called "motion" can no longer be conceived to subsist between them. There must, in short, be a common "while" between any two systems of which relative motion is asserted. But if there is a community of "whiles" there must also be a community of "whens," unless motion, change, and time-lapse are assumed to be discontinuous [pp. 653–654].

This argument seems to assume that motion is merely a matter of *time;* surely without *space* there can be no motion. This is implied in saying, "while S moves *to the right*, S' moves *to the left.*" Let us resort to the case of the fictitious twins that seem to have fascinated Lovejoy. Peter and Paul part from each other; the departure is an event that the two can experience in common. They meet again; here is another event they can experience in common. There is a time-interval for each between the two experienced events; but this interval is one in which motion is occurring—it is not merely a time-interval; it is a space-time interval. The relativist assumes that this space-time interval is identical for both. What is *not* in relativity identical for both is the *measure* of the time-factor in the common space-time interval. What Lovejoy does is to isolate the time-factor and the space-factor, and then claim that because in relativity the measure of the space-factor and the measure of the time-factor are respectively different for the two systems, there can be no *common* "duration."

But let us ignore the fact that there is a space-time interval involved. Let us consider the *time*-interval alone. The relativist properly objects to identifying his relativity with the *felt* relativity of the duration, say, of a lecture on relativity. To one person the lecture is long and to another it is short. The relativist objects because it is *unmeasured* durations that here are thus compared. But even here one need not say that there is not a community of "whiles," defined as the interval between the beginning and the ending of the lecture, both the termini being experienced in common. It is the *same* "while," that is long for one and short for the other—the same because identified by the same two terminal events. Now, before relativity came along, common sense accepted the proposal to give a physical measure to this "while," by "timing" the beginning and the end of the lecture by some physical process open to the inspection of each listener. The lecture began at eight o'clock by the clock on the wall, and ended at nine (or was it ten-thirty?) by the same clock. The duration of the lecture was still the interval between its beginning and its end, but this duration was *measured* by another interval, *viz.*, the interval between the reading "8" of the hour-hand of the clock and the reading "9." It is not because the

interval between the beginning and the end of the lecture has a common measure for both listeners that the duration of the lecture is a common duration; it is common duration because its beginning and its end are common. But this duration has a common measure for both listeners if the movement of *that* clock is adopted by both for taking the measure.

Now in relativity this still holds. Measured by the *same clock* the length of the duration of any time-interval is the same for every one; but measured by two different sets of clocks, one in motion relatively to the other, the length of that interval differs with the differing sets of clocks used for the measurement. If you and I are in relative motion, and I agree to use *your* clock as the measure of the interval between any two events, I (even if I were a relativist in physics) get the same length for that interval as you do. But if I use my clock and you use yours we need not (even if we are not physical relativists) get the same length. Does such a failure prove that there is not the same "while" that we thus measure with different results? The statement that there is no meaning for "while" unless there is "a *common* duration with a common measure," inverts the logical order. A common measure is possible only if there is something in common to be measured. When something in common is thus measured, it is assumed in physics that with an identical measuring instrument under identical conditions a common measure will be obtained by all measurers if the measurements are *ideally* made. But it is not necessary in physics to assume that, with different measuring instruments, even under *symmetrical* conditions (as in two systems in unaccelerated relative motion), a common measure shall be obtained; and of course in the case of two observers in relative motion it is only symmetrical and not identical conditions that can be realized when measuring the same duration; and in relativity the different "whens" are obtained by the use of different instruments, *viz.*, different clocks. Even Lovejoy admits that there is nothing inconceivable in the theory that clocks in relative motion fail to keep the synchronism they had when relatively at rest—without knowing the implication of the admission. He says in another paper: "But the variations of chronometers with varying conditions are likewise not wholly foreign to ordinary experience . . . he [Paul] would . . . feel a natural surprise on learning that in no respect had time-measurements on the earth kept in accord with his. Yet even this would not amount to a contradiction—not even if Paul retained a prejudice in favor of Newtonian time; and he could therefore, with no excessive difficulty, accommodate his mind to the conception."[11] Relativity-*physics*, like any other physics, is

[11] "The Paradox of the Time-Retarding Journey," *The Philosophical Review*, January, 1931, Vol. XL, pp. 50–51.

only a *metrical* physics. If chronometers do not run at the same rate on two relatively moving systems, and if each observer employs his own chronometer in measuring a time-interval, observers on two such systems, each using *only* his own chronometer, may have a common duration to measure and yet not get a common measure for the common duration.

After pointing out what I take to be extremely serious mistakes in Lovejoy's article and hinting that there are others, I am very glad to be able to subscribe to one statement he makes: "Philosophers ought not, I venture to suggest, to take over from physicists and mathematicians a new fundamental logic and a new metaphysics without a more active exercise of the critical faculty than has thus far—with some notable exceptions—been apparent" (p. 618). But even here I should wish to question whether this logic is so radically new, although of course it is not just the kind of logic that Lovejoy uses.

One may object to unwarranted criticisms of a theory without unconditionally subscribing to it. As I have maintained elsewhere,[12] it seems possible to deal with such experimental results as those of Michelson-Morley, Sagnac and others, without the use of the theory of relativity. Whether physical relativity be accepted for good and all remains to be seen. At present it apparently has in physics the field all to itself. As to the four-dimensional space-time interval of Minkowski I have serious misgivings: it treats the expression ct as a time-vector, whereas it seems rather to be a *space*-measure, since it is velocity multiplied by time. That this vectorial treatment works out beautifully in mathematics is unquestionable. But whether the mathematical "dodge," as Eddington calls it, whereby this is achieved results in a *physical* space-*time* measure is a question. But this is not the place to develop this doubt. If this doubt has a standing, it must be because it can be shown to be based on an understanding of the theory. At any rate, if it be the business of the philosopher to study relativity, it is also his business to exercise his "critical faculty" not arbitrarily but with discretion.

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A NOTE ON THE TIME-RETARDING JOURNEY

IN connection with the "Paradox of the Time-Retarding Journey" which has caused so much discussion amongst metaphysicians and rationalists, and which has recently been so admirably analyzed by Dr. Lovejoy,[1] I wish to point out some additional features which

[12] "Times, New and Old," The Annual Howison Lecture, University of California Publications in Philosophy, Vol. 6, No. 4, 1928, pp. 229–264. See especially pp. 253 ff.

[1] *Philosophical Review*, January, 1931.

so far as I know have not yet been touched upon. It appears to be admitted by all that in the two-system complex of motion of the twin brothers, Paul and Peter, the system of either brother may be considered as at rest or in motion, each with respect to the other. That is, if Paul takes it into his head to travel off at such a rate of speed leaving his brother Peter rooted to the spot in amazement and with nothing to do but to think it over, we may say that Paul is moving and that Peter is at rest. But anybody who cares to do so may with equal reasonableness say that Paul is at rest and that Peter is flying off into space. Whichever way we may look at it any of us might be pardoned the insinuation that both of the brothers were off on a fool's errand, and that little good was liable to come of it. But there is a third way to regard the relative movement of the hasty brothers, and that is to consider that they split up the amount of motion available so that each takes his proper share of it, and as a result we may consider that they are both moving. Depending on their natural capacities and on their personal predilections for action, we might extend the proposition even a little further and consider that Paul was the more energetic of the two and went twice as fast as Peter. There would be a considerable shift in the results of the paradoxes if this double motion was brought into the question. Since there is no more reason to suppose the one to be moving in preference to the other, there is, indeed, greater propriety in admitting the idea that both are moving.

There is, however, another point which does not seem to have been introduced. If Paul had decided to travel as fast as the relativists permitted he would surely have supplied himself with some sort of vehicle, whether a Ford or not is a matter of personal taste. We will suppose, however, that this vehicle is supplied with proper gear for assuming the responsibilities of the journey, that it is furnished with a good set of tires and a spare wheel in case of accident, and, of course, it has a speedometer properly adjusted to the rotating wheels so that the speed and the mileage can be properly observed. Otherwise, how would it be possible for Paul to know that he was going at the speed required in the problem? Much has been said about the clock on the machine that is carrying Paul, but the clock, in my opinion, is not nearly so important in its implications as the speedometer, for it does not keep a record of either time consumed, velocity attained, or space actually travelled. The clock only tells the position of the sun with respect to itself, and this can not have very much meaning in a problem where the existence of the sun is neglected, or at least it makes little difference as to what its position may be. If by introducing the clock the instigator of this paradox had the idea that he was in some manner or other bringing time into it, it would seem to me to be a rather clumsy kind

of time, and one which it would be exceedingly difficult to justify or accurately define. As the time which was allowed to elapse in the problem amounted to much over a day of twenty-four hours, and in fact rose up to as high as 200 years in the case of Peter, who was supposed to have been left behind, an ordinary clock would have been of little avail, and in the absence of any instructions to the contrary we have to suppose that it was an ordinary clock. By looking at the clock running for such a long period of time we would not know whether it was four o'clock to-day or next Thursday, or even of this year or thirty years hence. In other words, just what meaning an ordinary clock has in this connection I fail to grasp; it seems to me to be a totally useless encumbrance and incapable of telling us anything at all about "time" in relation to the journey of Paul.

But not so in the case of the speedometer, which would show a record of the speed attained and the total space traversed. And there is another very important point in this connection, and this is that both Paul and Peter would have a chance to tell which of them was actually moving. For if Paul were moving, he at least would observe that his wheels were going around while Peter's were not; also that his speedometer was functioning, whereas Peter would find his not indicating any movement. The scheme of employing measuring sticks for laying off the distance traversed in this trip, is impracticable, in fact, I would say that it is impossible. Outside of the fact that these measuring sticks shortened up in the direction of the motion, Paul would be moving far too fast to be able to make any application of them during his trip. The speedometer is by far more practical and accurate than the measuring stick, for not having any particular length, it would not be susceptible to the same eccentricities of standardization as the stick. Besides it would furnish a direct and continual measurement with an uninterrupted adjustment of totality, whereas the use of the stick would require a tremendous amount of bookkeeping and adding machines to keep track of the distance covered. It is true that the wheels of the car carrying Paul would have to go around with considerable activity to reach the speeds demanded in the problem, but this surely does not present any greater difficulties than those connected with the movement of Paul himself and his clock through space.

And this leads us up to another point which apparently has been neglected in the construction of the problem. A great deal of the proposition has to do with the perception of the clock carried by Paul through the senses of Peter remaining on the earth. Now as both Peter and the clock are supposed by definition to be moving at speeds approximate to or equaling the velocity of light, or 186,000 miles per second, if we will pause for a moment and give de-

liberation to the limitations of our optical apparatus, we will have to acknowledge that Peter would not be able to perceive either Paul or his clock at all. A bullet or even a large shell from a high-velocity gun is invisible to us even though these slowly moving objects have only a velocity of a few thousand feet per second. The objection here might be made that, on the contrary, we see a distant star which is supposed to be moving at much greater speeds than a bullet. But as a matter of fact we do not see the star. Even through the most powerful telescopes all we see is a point of light. It is from the behavior of the latter in our various instruments, particularly in the spectroscope, where the little point of light is expanded into a spectrum band of color, that we infer the existence of the star and a good many other things about it which are more or less problematical and dependent upon the interpretation of our presentations of the instrument. It is true that we, or rather the astronomers, seem to know a lot about the stars; in fact in many cases we know much more about these distant foreigners than we do of our next-door neighbor. But all our mathematical rationalizations concerning the stars do not cover up the fact that all we have really perceived is a mere point of light. If we bear these things in mind in treating the Relativity Problem we would feel a little temerity in expressing some of the hastily deduced conclusions that seem to spring up so unexpectedly to perplex our rather confused minds.

While we are on this question there is still another point to which I would like to call the attention of the Relativists and their host of analytical critics. In all discussions of the particular problem under consideration it is assumed that Paul undertakes his trip like a lone Lindbergh going forward through the midnight empyrean in what he would consider a straight line. Just why he considers it a straight line and just how he determines that it is a straight line and just how he maintains a constant course upon it are all very important points to be decided in the Relativity Problem, for many of the implications are dependent upon these features. As a matter of fact, if Paul and his clock travel forward as *objects* in a straight line, they are apparently the only objects in the universe that do so. It might be interjected here that light travels in a straight line; but light under these circumstances has to be treated merely as a vibration and not as a moving *object,* otherwise its velocity would be a variable function dependent upon the velocity of the body from which it was ejected. The motion of light in a straight line, besides, is a matter of *a priori* definition; for that is what a straight line is, the path of a ray of light. Now since every other body in the universe, from the smallest electron to the largest star, travels in a closed elliptical orbit, and since these

elliptical orbits are considered as located not in straightaway space but in a plane consisting of the surface of the Minkowsky curvature, it is reasonable to presume that the journey of Paul would be of the same order. It is easy to see that the movements of Paul as witnessed by Peter from a supposed state of rest on the earth would present a rather complicated track to follow. In fact, I am somewhat of the opinion that the very self-imposed conditions of the Relativity Problem would require the services of a highly expert mathematician acting in the interests of Peter in order that the latter might be kept informed of the actual whereabouts of his twin brother. The simple arithmetical spatial relations as given in the popular presentation of the Problem and which thus lead to the paradoxes in question, are totally without any real meaning within the scope of either the Special or the General Theory of Relativity. They merely represent absurd attempts to find things in this problem which are really not there at all, solely for the purpose of confusing the non-mathematical mind with impossible constructions. By carrying over into the implied conditions of the Relativity Theory a series of conceptions and ideas based entirely on the perceptual relations of the ordinary everyday earthly experience which has to do with a state of affairs in no wise moving with a velocity approaching that of light, the Paradoxicans are enabled to set up sophistical doctrines that seem to be substantiated by the definitions of the problem. It is true the conditions of the Relativity Theory are present in these earthly experiences as well as they are in the rather remarkable problems posited, but their influence is so minute that they are entirely without significance or recognition. They are like the infinitesimal left-overs in the differential calculus that drop out of the equations simply because they are too small and too insignificant to be retained within the meshes of our intellectual net.

This orbital motion of Paul and his clock is of course subject to the same reciprocal relation as that pertaining in the straight away speculation; that is to say, Paul may be considered at rest and Peter may be considered as the moving member of the family, and under the circumstances as outlined, the motion of Peter as observed by Paul would be subject to rather eccentric and complicated wanderings through space, and it would require a clear mathematical mind to follow them with certainty and precision. There would be a further complication in the fact that the speedometer of Peter would remain at zero all the time while that of Paul would be spinning around to high records, and this, perhaps, would be an inexplicable situation to both Paul and Peter. But without pursuing this feature of the case beyond the point of merely calling attention to it, and returning to the proposition that Paul is really supposed to be doing the traveling, since we have concluded that actually he

must be moving in an elliptical orbit confined to the planar surface of a Minkowsky curved space, it is easy to see that Paul will eventually return to the point from which he started, even though his motion may be considered as continually forward and never reversed. His journey away from his brother will not be the same path as his journey of return to home and family. Now the question arises, how will this necessity of orbital motion with its implication of successive returns of Paul and his clock, or as the case may be, of his speedometer, to the point of departure, affect the paradoxes in the problem? I believe they will very greatly affect them and under the circumstances a whole new set of paradoxes will have to be constructed. But this I will leave to those who possess a congenital inclination towards such things, and who are more competent mathematically to perform the necessary transformations than I am.

There is one last point to be considered that has also been neglected in all the presentations of the Problem that I have run across. This is the complexity introduced by the axial rotation of the earth. Now this is a form of motion that is not dependent on the relation to any other object or point of reference outside of the earth itself. If the earth was the only object existing in the universe any motion of translation, whether straightaway, curved, periodic, or what not, would be incapable of existence, or if it were even capable of existence, it would be absolutely meaningless; as motion at all would be impossible except as it is a change of position, and as there would be no position in the universe except that in which the earth happened to be, and as the earth could not move away from itself, it would always be in the same position. Confining our attention for the time being to Peter who would be greatly concerned with the gyrations of Paul, who by his departure from the earth had become a second object in an otherwise unpopulated universe, we would find that our home-loving twin would also be involved in a predicament, which probably he would have no way of investigating, because the predicament is a perturbation without his own system of reference, though it is doubtful if he has at his disposal any method of experiencing it. The fact that his earth was rotating on a set axis could only become aware to him directly by its effect on the relative positions of surrounding objects. For otherwise Peter would be like any of us at the present time, perfectly unaware of any motion of the earth at all and firmly convinced, just the same as we are, that the earth is the one heavenly body that is at rest; that it is the one fixed, immovable point in all space, the permanent position of rest which serves as the zero point for all coördinates of space, time, and velocity. But just the same Peter would be subjected to a rotary movement of his own fixed position, and while he would not be able to experience the cause of his mix-up, neverthe-

less, the fact of this rotation would have considerable influence on determining his perception of the movements of Paul and his clock, or even his speedometer, if we are allowed to introduce this into the problem.

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BOOK REVIEWS

Der Begriff der Tatsache in der positivistichen Philosophie des 19. Jahrhunderts. LUCIA GRUNICKE. Halle: Max Niemeyer. 1930. 199 pp.

Positivism might almost be called "Fact-ism," if the latter sounded a little less harsh to the ear, for it professes to be the philosophy which confines itself to facts and their relations. Little argument is needed to establish the obvious centrality, in any discussion of positivism, of the question: "What is a fact?" So crucial is its importance that the author of this monograph alleges that it can be only answered in terms of whole systems. What any individual positivist means by a fact can be fully understood only in the light of his entire philosophy.

In this book she undertakes to apply this thesis to the systems of Comte, John Stuart Mill, Spencer, Laas, Schuppe, Avenarius, and Mach. The resulting study is largely one of German positivism in the nineteenth century, which, as everyone knows, differs in many respects from the French and English varieties. The writers most thoroughly treated are the idealistic or "economical" positivists rather than their more empirical brethren, who receive, on the whole, short shrift. Auguste Comte, the author maintains, is rightly regarded as the founder of positivism, but he is by no means "a typical positivist" (one suspects that this should read "a typical German positivist"). He relied naïvely on the facts of the natural sciences, by which he meant what had been "observed" in accordance with scientific criteria which he did not take the trouble to scrutinize. Self-analysis by the knower he rejected, and with it any possibility (Professor Lévy Brühl's protestations to the contrary notwithstanding) of a genuine psychology. Laws and facts have for Comte the same degree of objectivity, and the subjective factors in both are deplorably slighted. John Stuart Mill took a more sophisticated position: facts, for him, are admittedly facts of consciousness, and are divided into the purely subjective and the partly objective, the latter referring merely to "the unknown and inscrutable process by which the subjective or psychological fact is brought to pass." Facts rest upon sensations, and ultimately upon the mysterious causes of sensations. How the "unknown cause," Body, affects the "unknown re-

cipient," Mind, in such a way as to make inductive knowledge reliable, remains a puzzle. Herbert Spencer similarly evokes relative knowledge in terms of sensations from two absolute unknowables. He goes beyond Mill in endeavoring to base sensations upon a metaphysical foundation, an absolute which can be known to exist and yet remains itself unknowable. He did not distinguish clearly between categorical and empirical ordering-principles, says the author, or between his "inner" and "outer" relations. The classic English and French positivists are thus indictable on at least two counts: they can not get along without metaphysics; and their theories of knowledge, to put it mildly, lack psychological subtlety.

The latter, of course, German positivism abundantly supplies. Ernst Laas, in many ways its clearest representative, also achieves a singular degree of abstention from metaphysics. The core of his doctrine is his emphasis upon the notion of perceptions (and possible perceptions) as indications of correlations between subject and object. When these inseparable subject-object correlations are examined further, however, it is the objective aspect that gains in importance. Objects are neither "in us" nor "outside us," but are rather "in relation to us as we are in relation to them." Kant, although he is recognized as "*halbpositivistisch*" by Laas, was writing mere psychology. "*Wir haben zu lernen, nicht zu 'machen.'*" Wilhelm Schuppe resembles Laas in beginning with a given fusion of subject-object in which the ego appears as the first and surest of facts. What appears to be headed for subjective idealism turns out to be a doctrine of immanence, in which an outer world exists independently of (although it is only discoverable in) a sort of common consciousness. Richard Avenarius likewise takes experience as his point of departure, refines it, and emerges with a "pure experience" that is neither "physical" nor "mental," except for purposes of discourse, but rather an aggregate of homogeneous elements which may be arranged into many sorts of systems. This expands enormously the domain of the factual, for, according to Wundt, Avenarius regards as a fact "anything that belongs among the contents of pure experience." Ernst Mach shares with Avenarius this breadth of hospitality toward all manner of "facts." Anything experienceable may be a fact. For it to become a fact for us, however, its neutral elements must go through a process of complex-making that we call thinking. But by building his known world from sensations, Mach runs a great risk of slipping over into metaphysics.

The book closes with an all-too-brief critical comment on positivism, especially in the light of Kant, which confines itself to pointing out its fundamental epistemological problems: those of a starting point for knowledge (all the given, or what parts?), and of the

disputed division (as between subjective and objective) of the various elements which constitute facts. Since Kant, the roads open to the positivists have been fairly well defined. If the subjective elements are not to be entirely withdrawn from nature, they must be located in some scheme of progressive discovery or invention of natural laws by men and nature acting in concert. Comte's contribution was the idea of a collective knower enlarging the stock of relative knowledge (relative in several senses) through distinguishable historical epochs. But this, according to our author, does not solve the real problem of positivism, which concerns the determination of the nature and validity of scientific thinking *überhaupt*, apart from all historical considerations whatever.

All positivists, it seems, agree in being relativists about knowledge, but what many of them do not seem to realize is that if knowledge is to be suspended in some sort of subjective-objective concatenation in the midst of nature, many kinds of relativity are involved. It is, therefore, just as illegitimate to construct a theory of knowledge around a single kind of relativity as typical, as it is to construct an absolute from an arbitrarily selected sample of human experience. Both are measures of economy which misrepresent life. Positivism will continue to display its traditional weakness in epistemology until some one appears who refuses to oversimplify the complexities entailed in any theory of knowledge which rejects transcendentalism. It may even turn out that the positivists, like their arch-opponents, the absolute idealists, but for a different reason, may have to wait until all facts are known before they can be sure what a fact is.

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The Problem of God. EDGAR SHEFFIELD BRIGHTMAN. New York: The Abingdon Press. 1930. 209 pp.

In the present volume are incorporated a series of lectures, delivered on the Adams Memorial Foundation of the First Methodist Episcopal Church of Bloomington, Indiana, the Church of the Wesley Foundation at Indiana University, together with a Goldwin Smith Lecture delivered at Cornell University in 1929. The book is planned "for those who have problems and who sympathize with the problems of others" (p. 9). It is not a point of criticism, therefore, that the discussion is attuned to catch the popular ear, and would not be unwelcome in the same women's clubs which Walter Lippmann has so naughtily invaded (p. 14). The opening lectures, in which "Contemporary Doubt" and present-day "Substitutes for God" come in for strong handling, make the way easy for the lay reader, with neat flings of wit and irony: "the rising tide of doubt":

"a new crop of doubters every month"; "the first preface to morals was framed by that famous early doubter, Cain, when he asked, 'Am I my brother's keeper?' "; "even pleasure-loving and materialistic hedonists among the Greeks and Romans, like Epicurus and Lucretius, doubted only the divine interest in human affairs, not the reality of divine beings"; and so forth. Labels, such as "theist," "skeptic," "anti-theist," are attached to the usual names—Freud, Watson, Darrow, Barnes, Clemenceau, Huxley, Russel, Vaihinger, Nietzsche and company. But in addition they are flung at some newcomers—O'Neill, Krutch, Lippmann, and Cohen, and pinned on the more tender-minded Hoeffding, Mauhner, Ziehen, Sellars, Dewey, Alexander, Spaulding, Perry, and Bosanquet. A motley crew, to be sure; but alike in one respect, and that is sufficient; all of them have taken occasion to criticize severely the doctrine of personal theism which Dr. Brightman anxiously defends. Most of them have contributed to the list of "substitutes" for God, of which Dr. Brightman is so scornful.

The fundamental thesis of the book is that the doctrine of a personal Supreme Being is on the whole the best hypothesis in terms of which fundamental questions can be answered and fundamental problems solved. The evidence for this thesis, marshalled in the sixth lecture, is scarcely original. It is drawn from familiar and admitted facts; law and order in the universe described by science; the emergence of novelties in the course of evolution; the existence of human personality and human values; the purposive aspects of nature; and the orientation of religious experience towards an external object of devotion. The organic interpenetration and unity of these facts, their "systematic coherence," constitutes the final argument. ". . . reality is one ongoing system, an incessant activity controlled by rational laws and achieving consciousness and value. Such a reality is better understood as the life work of a Supreme Person than in any other way. . . . Acceptance of the proposition that he exists and manifests himself in the ongoing of experience leads to the most connected and coherent view of our experience as a whole" (p. 162).

It is perhaps superfluous to point out that everything is established except the essential point, the necessity of interpreting these facts in terms of a Divine Being. The admission, customary in treatises of this sort, that the existence of God can not be proved with the finality of a mathematical demonstration, indicates that each bit of evidence is meant more as corroboration than as definite proof: "if God is, this is the sort of thing one would find in His universe." And when the author concludes the whole matter by stating "We believe that God exists" (p. 162), there is nothing more to say.

Yet it may not be amiss to point out that a different approach to the problem might have avoided the need of taking refuge in a confession of faith. The discussion opens with the *idea of God* as its problem, not with the *facts of experience* and their need for religious interpretation. "The Problem of God has grown out of the conviction that the idea of God is in need of revision" (p. 9). The main task of the philosopher is to prove or disprove the existence of a reality corresponding to the idea. Of course the idea may need some patching up; in fact, as we shall see below, the author tries his hand, with interesting results. But the method is apologetic, not philosophical. "Here is an idea philosophy must reckon with. What are its advantages, its contributions? What has it meant in the lives of men? What are its weaknesses? Can we remedy them without serious damage? Are there any real substitutes? What shall we lose if we lose the idea of God?" Might not the same question be directed toward any concept, true or false, partial or adequate? "What did mankind lose when it ceased to believe in the idea of the flatness of the earth?"

The fundamental futility of this method of attack lies in its inability to envisage the real problem, in its inability to ask a new question. It is aware of the unsolvable contradictions, the inherent antinomies within the idea of God itself. The neatest section of this neat book are the chapters (III and IV) entitled respectively "The Expansion of God" and "The Contraction of God." They present in concise and suggestive formulation the paradox involved in the notion of a Supreme Being who is magnificent enough to comprehend within his being the universe which modern science has discovered, and who is at the same time tender, just, merciful, compassionate, "mindful of his own." But when asked for a way out, it can only suggest another epicycle. It is ready to admit the chaos of argument and discord which the idea engenders. But it is helpless before the impasse; it must confess, "We can not hope to agree on an idea of God" (p. 111). It must rationalize the failure: "The argument for God, especially for the highest idea of God, will not be convincing to all" (p. 112). It must take refuge in a special insight, in a revelation of values to a few (p. 112).

This impotence pervades even the more original part of the book, the lectures (Chapters V and VII) in which the author endeavors to relieve the idea of God of its fundamental paradox by modifying the orthodox conception in the direction of a less free and unlimited deity. As this constitutes the more important contribution of the treatise, the author may speak for himself:

> The Given is the source of an eternal problem and task for God. It is irrational, not in the sense of being given to logical contradictions, or immoral purposes, but in the sense of being given to reason as a datum and not

derived from rational premises or purposes. In itself it cannot be understood; yet an understanding use may be made of it, and through the conquest and shaping of its meaning may be achieved. Our hypothesis is that God can make an increasingly better conquest of it throughout eternity without ever wholly eliminating it. The divine perfection, then, is an infinite series of perfections [pp. 182–183].

If we suppose that God is eternally both matter and form, then from eternity to eternity the divine reason is unchangingly rational, yet also from eternity to eternity the divine will has The Given as a stimulus to activity and as a source of problems to solve [p. 190].

It is needless to list the many ways in which this doctrine is ingeniously elaborated, or to comment upon the tender feeling with which the author expresses his sense of human suffering and frustration, and the philosophical issue involved. As an endeavor to reshape the traditional picture of deity along more merciful lines, the book modifies and elaborates the suggestions of William James and H. G. Wells with a metaphysical imaginativeness neither possessed. It will afford comfort and sustenance to many people who have become aware of some immediate difficulties in holding to the religious symbols of Christian theism, but are not ready or equipped to make a radical readjustment.

This is to say that the *Problem of God* belongs to the Ptolemaic era in the philosophy of religion. It revolves within a set of concepts whose inherent self-contradictions have long disappointed any hope for a realistic and coherent interpretation of the object of religious devotion. None of the antinomies disappear; their locus is merely shifted—this time to a place within the psychic life of the deity. The philosopher is still confronted with the insoluble problem of assimilating within a Supreme Personality that which is categorically antithetical to personality—the irrational, the material, the gross, the impersonal.

For a generation or two the religious experience in all its aspects has been intensively studied. Its cycle of development has been outlined; its place and value in human experience begin to be clear. No informed person is any longer "anti-religious." The study has also been extended to the objective reference of the experience, to the "environmental stimuli," the "divine qualities of existence," which call forth the religious attitude. To describe these as accurately and as scientifically as possible has been a major task of most of the thinkers whom Dr. Brightman accuses of inventing "substitutes for God." In carrying out this task, a revolution in the field of religion has been wrought comparable to the Copernican in the realm of astronomy. It is not too much to say that the spadework of psychologist, sociologist, and philosopher has done more in thirty or forty years to clarify the idea of God and to vindicate religion than many centuries of theologizing. It is almost inconceiv-

able that any person could so utterly misunderstand what his own age is doing.

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JOURNALS AND NEW BOOKS

REVUE DE METAPHYSIQUE ET DE MORALE. 38e Année, No. 2. Y a-t-il une philosophie chrétienne: *E. Bréhier.* La non-existence de l'existence: l'idéaliste pur et le réaliste hypothétique: *C. Ladd-Franklin.* De la vraie et de la fausse conversion (*suite*): *L. Brunschvicg.* Les débuts philosophiques de Descartes: *L. Robinson.* Les aspects principaux de la philosophie allemande contemporaine: *E. Von Aster.*

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Carbonara, Cleto: Léon Brunschvicg. (Biblioteca di Filosofia) Napoli: Francesco Perrella. 1931. 72 pp.

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Gillet, M.: La Philosophie de M. Meyerson. Ètude Critique. (Archives de Philosophie, Vol. VIII, Cahier III.) Paris: Gabriel Beauchesne. 1931. 116 pp.

Archives de Philosophie, Vol. VIII. Supplément Bibliographique, No. 3. Paris: Gabriel Beauchesne. 1931.

Lewis B. Roland: Creative Poetry. A Study of Organic Principles. Stanford: Stanford University Press. 1931. London: Humphrey Milford, Oxford University Press. xi + 399 pp. $5.00.

Pfeiffer, Johannes: Das lyrische Gedicht als ästhetisches Gebilde. Ein Phänomenologischer Versuch. Halle (Saale): Max Niemeyer. 1931. 113 pp. 5.50 M.

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Smith, Henry Lester, and Littell, Harold: The Philosophy of Human Relations.—Individual & Collective—A Source Book. (Bulletin of the School of Education, Indiana University, Vol. VII, No. 3.) Bloomington, Ind.: Bureau of Coöperative Research. 1931. 326 pp.

Sprietsma, Cargill: We Imperialists. Notes on Ernest Seillière's Philosophy of Imperialism. New York: Columbia University Press. 1931. 153 pp.

NOTES AND NEWS

We have received the following notice concerning the publication of Nicolai Copernici: *De revolutionibus orbium coelestium libri sex.* E codice qui in Bibliotheca Nostitziana Pragae servatur, cum consensu possessoris. Lucis Ope Depictum. Sumptu Speculae Astronomicae Rei Publicae Bohemoslovenicae Pragensi. Praefatus est Q. Vetter, Ph.D.

Nicholas Copernicus finished his celebrated work about 1530. The first printing was made at Nuremberg by Georges Joachim Rhaeticus between 1541 and 1543. This first edition differs from the original manuscript, in which several changes were introduced later. This edition has served as the foundation for all later editions.

The manuscript changed owners, and the world of scholarship lost sight of it in course of time. Copernicus had entrusted it to Rhaeticus, after whose death, in 1574, it passed to the Library of Valentin Othon, pupil and editor of the work of Rhaeticus. On December 19, 1603, it was acquired by Professor Jacques Christmann of Heidelberg, whose widow sold it, January 16, 1614, to Jean Amos Comenius. After the sack of Fulnek, at the end of 1620, the library of Comenius fell into the hands of the Spanish army, but, by a happy chance, the manuscript had become, by 1626, the property of the Baron, later Count, Nostitz de Praha. In 1840, it was discovered by Dr. Hillardt and April 30, 1840, Dr. K. S. Amerling, proclaimed this discovery by a first notice published in the appendix of the journal "Kvety."

The International Astronomical Union, which assembled in 1922 at Rome, recommended the publication of the manuscript in facsimile. For this reason, the National Observatory at Prague and the International Committee of the History of the Sciences at Paris, have decided to publish, with the authorization of the actual owner, M. Erwein Nostitz-Rieneck, a photographic facsimile in heliogravure of the manuscript of Copernicus on condition that sufficient funds can be procured following this invitation for subscriptions.

The manuscript has 212 pages. A sample page of the reproduction can be obtained. Subscriptions are taken until October 1, 1931, at the price of $35.50 for the bound volume. The price to the public will be $44.40.

Subscriptions should be sent to the Observatoire National de la République Tchécoslovaque, Klementiunum 1, p., Praha, I. Czechoslovakia.

The 1931 Meeting of the American Psychological Association will take place at the University of Toronto, Toronto, Canada, September 10, 11, and 12.